higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

REPORT 191 PROGRAMMES

SYLLABUS

FAULT FINDING AND PROTECTIVE DEVICES

N4

SUBJECT CODE: 8080104

Implementation: May 2024

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Syllabus: Fault finding and Protective devices N4

1. General Aims

To equip students with problem **solving technics and process**, applied to failed products on a machine or a system and to develop students' ability to solve electrical problems and adhere to safety standards and procedures.

2 Specific Aims

The students must be able to:

2.1 collect and analyse evidence to locate and rectify the fault in electrical / electronic circuits as applied in industry.
2.2 classify individual electrical components into various stages as found in electrical apparatus.
2.3 interprets electrical drawings and applications of electrical testing instruments

3. Pre-requisite

Student must meet at least one of the following requirements.

3.1 Completed National "N" certificate with
Electro technology N3/ Electrical Trade Theory N3.
3.2 Passed grade 12 with Mathematics and Natural Science or Electrical subjects.
3.3 Completed NCV level 4 in any electrical relating engineering programme.
3.4 Passed senior certificate for adult learners with at least (level 4 50% or D symbol) in Mathematics and Physical Science.

4. Duration

Full-time: 7.5 hours per week. This instructional offering may also be offered part-time.

5. Evaluation

5.1 Evaluation is conducted continuously by means of two formal tests at College level. Learner must obtain a minimum ICASS mark of at least 40% in order to qualify to write the final examination and a mark will be calculated together in a ratio of 40:60 to derive the promotion mark. The learner must obtain at least 40% on the final examination.

The promotion mark will be calculated as follows:
Promotion Mark **= 40%** of (ICASS mark) **+ 60%** of (Exam mark)

5.2 The examination in Fault Finding and Protective Devices N4 (Engineering Studies - Report 191) will be conducted as follows:
Modules 1 to 3 MARKS: 100
DURATION: 3 HOURS

CLOSED BOOK: Formula sheet is attached to the question paper.
Scientific calculators NOT allowed.
No programmable calculators allowed.
No references allowed.
No external examination papers or memoranda allowed.

5.3 Weighting:

The following weights are consequently awarded to each category:

Knowledge and Understanding	**Applying**	**Analysing / Syntheses and Evaluating**
35 – 40	30 – 40	20 – 25

6. Learning content

THEORETICAL BACKGROUND

It is essential that this subject should be illustrated and evaluated within the context of practical case studies.

TECHNICAL BACKGROUND

It is essential that this subject should be illustrated and evaluated within the context of technical skills and simulation of practical environment.

7. Mark allocation in the examination as an indication of the weighting of the different modules

MODULES	WEIGHTING
1. Heavy Current	**40**
2. Light Current	**40**
3. Binary Logic and Boolean Algebra	**20**
TOTAL	**100**

Module 1: Heavy Current

General aim

On completion of this module, the student should be able to explain the theoretical and practical application of the following concepts: electrical circuits, electromagnetism, and magnetic circuits.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
1.1 Fault Finding Techniques	1.1.1 List and explain the fault finding approach used to locate and correct the malfunctioning of electrical circuit(s)
	1.1.2 Name and describe the following different aids concerning the documentation of fault finding: ● Completion of work load ● Equipment problem ● Recommended for repair
	1.1.3 Describe the following methods of fault finding ● Scientific approach ● Systematic ● Half –cut method
1.2 Schematic diagrams	1.2.1 Draw and explain the action and reaction Starting methods of the following: ● Direct on line ● Forward –Reverse ● Star-Delta ● Slow fast
1.3 Measuring Instruments	1.3.1 Explain the operations of the following: measuring instruments by means of a labelled circuit diagram. ● Voltage Tester ● Moving coil meter ● Wheatstone Bridge.

	1.3.2 Draw label circuit diagram of the following instrument: ● Voltmeter (analogue and digital) ● Ammeters (analogue and digital) ● Moving coil meter ● Voltage Tester (analogue and digital) ● Wheatstone Bridge.
1.4 Motor Protection	1.4.1 Name types of overload protection and draw their Symbols. 1.4.2 Draw and explain the operation of electro-magnetic overload relay function when it senses an overload.

Module 2: Light Current
General aim

On completion of this module, the student should be able to know the use of an Oscilloscope and to explain, draw different component of a Resistors, Capacitors, Inductors, Diodes, Cathode Ray Oscilloscope, Transistors and SCR as well as the operation of SCR, CRT and Transistors.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
2.1 The Cathode Ray Oscilloscope	2.1.1 Draw a circuit diagram or block diagram of the Cathode Ray Oscilloscope and label the main parts.
	2.1.2 List and explain the function of each component of a Cathode Ray Oscilloscope.
2.2 Electronics components	2.2.1 Explain the factors which affect resistors and factors which influence the capacitors of capacitances, name the types of resistors and capacitors.
	2.2.2 Name advantages of metal oxide resistor and Ceramic capacitors.
	2.2.3 Draw the IEC symbol of the following components: ● Capacitors ● Resistors. ● Inductor ● Zener diode ● Transistor
	2.2.4 Draw a of fully labelled circuit diagram the half-wave rectifier and full wave rectifiers, show the input and out wave forms.
	2.2.5 Explain how to test a diode to determine if it is faulty or not.
	2.2.6 Draw a fully labelled characteristics curve of a silicon diode.
	2.2.7 Make a sketch of a diode to show the methods that is used to compensate for the Zener diode temperature coefficient effect during manufacturing.
2.3 Diodes and their applications	2.3.1 Name the types of diodes and draw their IEC symbols.
	2.3.2 Draw fully labelled characteristics curves of different diodes.
	2.3.3 State the applications of different diodes.
	2.3.4 Explain the operational principles of diodes.
2.4 Transistors and SCR's	2.4.1 Name THREE elementary amplifier circuits.
	2.4.2 Draw an NPN transistor showing the correct DC biasing.

	2.4.3 Draw a circuit to show how an SCR can be used to control the power from DC source into a load resistor.
	2.4.4 Name THREE methods that will cause an SCR to conduct electricity. 2.4.5 Explain how convectional current flows through an NPN transistor when it is forward biased.
	2.4.6 Draw two equivalent SCR transistor circuit and explain its operation.
	2.4.7 Find solutions to different calculations of Zener diode and transistor: ● Calculate the series resistance (Rs) of a Zener diode. ● Calculate the load resistance (RL) of a Zener diode. ● Calculate the supply voltage of common emitter amplifier Vcc. ● Calculate the base resistance Rb. ● Calculate the collector resistance Rc. ● Calculate the collector current Ic. ● Calculate the emitter collector for voltage Vce.

Module 3: BINARY LOGIC AND BOOLEAN ALGEBRA

The field of digital electronics make use of many devices which have only two possible conditions or `states'. Some familiar devices having only two states which is on or off. Binary logic is a name given to the process where the factors or variable being considered in only one or the other of two states.

3.Logic circuits	3.1 Draw the IEC symbol, electronic circuit and truth table of the following: ● "OR" gate, ● "AND "gate, ● NOT gate(inverter), ● "NOR" gate ● "NAND" gate 3.2 Describe the operation of the following: logic gates ● "OR" gate, ● "AND "gate, ● NOT gate(inverter), ● "NOR" gate ● "NAND" gate 3.3 Simplify and prove Boolean expression. 3.4 State and apply laws and identities of Boolean Algebra. 3.5 Apply De Morgan theorem, to solve or simplify Boolean expressions. 3.6 Demonstrate ability to convert between the binary, and decimal systems

	3.7 Convert Boolean expressions to logic gates
	3.8 Use truth tables and laws of identity, distributive, commutative and domination.
	3.9 Explain the simplification of logical statements with using Boolean rules and de-Morgan theorems.
	3.10 Writes Boolean by using table and shows its logic circuits.
	3.11 Writes Boolean equation by logic circuits and shows its truth table.